

We claim

1. A method for deposition of coating, comprising a plurality of microlayers, wherein each of said microlayers comprises a material selected from the group consisting of the Group IVA - VIA metals and alloys thereof, or interstitial phases based thereon, wherein one or more of said microlayers is subjected to high energy non-metallic ion deposition; also a method for improvement of durability of machine components by said coating deposition followed by vibromechanical treatment with micro-pellets; said method including the steps of:

- (i) locating said machine components as an anode inside an ion-plasma deposition chamber;
- (ii) locating a cathode comprising a metal selected from said metals and alloys thereof within said chamber;
- (iii) feeding said chamber with a gas atmosphere wherein the gas is selected from the group consisting of inert or non-inert gases and mixtures thereof;
- (iv) ion cleaning of surfaces to be coated;
- (v) effecting selective ion-plasma deposition of said microlayers comprising said metals or alloys thereof or interstitial phases based thereon;
- (vi) subjecting one or more of said microlayers to high energy non-metallic ion deposition;
- (vii) cooling and unloading said machine components or articles from said chamber followed by vibromechanical treatment with micro-pellets.

2. A method as defined in claim 1, wherein said machine components or articles are selected from those made of materials comprising titanium, titanium alloys, steels or nickel-based alloys.

3. A method as defined in claim 1, wherein said cathodes are selected from those made of materials comprising titanium, titanium alloys, steels or nickel-based alloys that after deposition provide composition similar to the base material of the components or articles.

4. A method as defined in claim 1, wherein said plurality of microlayers is selected from the numbers 3-500, and increasing the number of microlayers is effected through alternating said metals, alloys of said metals or interstitial phases based thereon.

5. A method as defined in claim 4, wherein said microlayers are deposited at a thickness proportion of (0.02-0.5): (0.04-10): (0.1-12.5), in which the first three layers are deposited at a thickness proportion of 1 : 2 : 2.5.

6. A method as defined in claim 1, wherein said ion plasma deposition comprises depositing a microlayer consisting of scandium, yttrium or other rare earth metal to a thickness selected from 0.02 - 0.08 micron following said ion cleaning according to step (iv) before the step (v).

7. A method as defined in claim 1, wherein said gas is selected from the group consisting of nitrogen, acetylene, methane and diborane.

8. A method as defined in claim 7, wherein formation of layers of the alloys and interstitial phases is provided by the ratio of  $(0,005-0,2 : 0,01-7,0)10^{-1}$  Pa between partial pressures of the reaction gases.

9. A method as defined in claim 1, wherein said high-energy non-metallic ion deposition is effected with said non-metallic ions selected from the group consisting of argon, nitrogen, carbon, and boron at an accelerating voltage selected from 10-50 kV, at a radiation dose of  $10^{14} - 10^{18}$  ion/cm<sup>2</sup> and an energy of ions of  $5 \times 10^3 - 1 \times 10^5$  eV.

10. A method as defined in claim 1, wherein said vibromechanical treatment is effected not later than 10-60 min upon coating deposition, with micro-pellets of 0.5 - 5.0 mm in diameter at an amplitude of 2 - 8 mm.

11. A method as defined in claim 1, wherein said ion-plasma deposition step (v) comprises the steps of selectively depositing:

- (a) a scandium submicrolayer in argon atmosphere;
- (b) a titanium microlayer in argon atmosphere;
- (c) a microlayer comprising a solid solution of implanted nitrogen ions in titanium in an atmosphere comprising a mixture of nitrogen and argon;
- (d) a microlayer comprising titanium nitride implanted with nitrogen ions in nitrogen atmosphere;
- (e) a zirconium microlayer in argon;
- (f) a microlayer comprising a solid solution of implanted nitrogen ions in zirconium in an atmosphere comprising a mixture of nitrogen and argon;
- (g) a microlayer comprising zirconium nitride implanted with nitrogen ions in nitrogen atmosphere; and

(h) the step of repeating said steps (b-g) to provide the required plurality of microlayers.

12. A method as defined in claim 1, wherein said deposition step (v) comprises selectively depositing:

- (a) a first microlayer comprising alloys of titanium and zirconium in said inert gas atmosphere;
- (b) a microlayer comprising said alloys of titanium and zirconium implanted with nitrogen ions in an atmosphere of a mixture of said inert gas and nitrogen;
- (c) a microlayer comprising titanium and zirconium nitrides implanted with nitrogen ions in nitrogen atmosphere;
- (d) repeating said steps (a - c) to provide said plurality of microlayers;
- (e) high energy ion deposition with argon ions of the resultant coating comprising said plurality of microlayers.

13. A method as defined in claim 12, wherein said step (b) comprises depositing titanium and zirconium alloys with carbon in a mixture of an inert gas with acetylene or methane, and wherein said step (c) comprises depositing titanium and zirconium carbides implanted with carbon ions in an atmosphere of acetylene or methane.

14. A method as defined in claim 12, wherein said step (b) comprises depositing titanium and zirconium alloys with boron in a mixture of an inert gas with diborane, and wherein said step (c) comprises depositing titanium and zirconium borides implanted with boron ions.

15. A method as defined in claim 1, wherein said machine components are gas turbine compressor blades and vanes or parts thereof.